Students are given objects of the same size and shape but with differing masses. The students are asked to drop the objects from the same height and find the relationship between the drag force and terminal velocity. The magnitude of the drag force is proportional to objects velocity, Fd = -bv. The data is recorded in the table below.

|  |  |  |
| --- | --- | --- |
| Object | Mass(g) | Terminal Velocity(cm/s) |
| 1 | 10 | 12 |
| 2 | 20 | 27 |
| 3 | 30 | 35 |
| 4 | 40 | 48 |
| 5 | 50 | 63 |

a) i) Draw a free body diagram immediately following release

ii) Draw a free body diagram once the object has reached terminal velocity

Label all forces with appropriate length vectors in terms of b,v, m, g.

b) Construct a graph with best fit of the terminal velocity vs the mass of the object.

c) Plot representative acceleration vs time graph for the object. Assume that down is the positive direction.

d) Based on the plotted data, find the value of b.

e) Write the differential equation of motion for the falling object.